

EXHIBIT P

Genetic advance may transform corn

By George Gunset

Farmers will be able to grow America's most valuable crop more cheaply while keeping the environment safer if scientific breakthroughs disclosed Wednesday develop as promised.

Using similar new gene technology, plant scientists working for DeKalb Genetics Corp. and Monsanto Co. have, for the first time, transferred to corn plants desirable traits that can be passed onto the next generation.

Genes resistant to insects, plant disease and herbicides are likely to be the first commercial applications, scientists said. The result would be higher corn yields, lower costs for farmers and reduced use of chemicals on cropland.

"This is a tremendous breakthrough for a principal cereal crop," said Karel Schubert, assistant director of the Center for Plant Science and Biotechnology at Washington University in St. Louis.

Corn is the major grain used to feed cattle, hogs and poultry and is the grain most in demand by overseas buyers, making it a major contributor to the U.S. trade balance. Corn's cash value can exceed \$22 billion in a year, and it is the mainstay of the Midwest farm economy.

Scientists at Biotechnica International of Cambridge, Mass., last month announced they had succeeded in genetically transforming corn, but the report was sketchy and didn't provide any details on the method used or the gene transferred.

Plant varieties containing useful new genes won't be in the hands of farmers soon, however.

"Even if we had a product with commercial potential we could begin field testing this summer, it would take at least three years to

put it on the market," said Thomas B. Rice, president of DeKalb's seed operation, DeKalb-Pfizer Genetics. "What is important here is the process."

The process for both Monsanto and DeKalb involves a "gene gun" in which microscopic "bullet" genes with the desired trait are fired into cultured corn cells. Plants regenerated from these cells transferred the gene into their seed, which in turn yielded new plants with the desired trait.

Gene transfer has proven difficult to achieve in corn as well as other plants, called monocots, that sprout only one leaf from germinating seed. Wheat, oats, barley and rice also are monocots. Dicots, such as tomatoes, tobacco and rapeseed, have been easier to genetically engineer.

DeKalb's scientists transferred a gene resistant to the herbicide bialaphos, used in Europe. A corn plant resistant to a herbicide would allow farmers to control weeds in the field without hurting the corn.

In Monsanto's research, conducted with the Agriculture Department, one gene was resistant to a growth inhibitor. Another gene transferred into corn cells was derived from the gene that causes fireflies to glow. Once transferred, this gene triggered corn cells to make small amounts of light invisible to the naked eye. When these adult plants were fertilized, half produced a new generation of seedlings carrying the "marker gene" that scientists could detect because of its light.

"We linked the two marker genes so we could use a special low-light detection machine to identify cells that have accepted both genes," said Michael E. Fromm, molecular biologist with the department's Agricultural Re-

search Service and a lead researcher on the project.

The findings were disclosed at a national symposium on genetic engineering of crops at Keystone, Colo.

Schubert of Washington University called the new process a first phase in genetically engineering corn and other cereal crops.

"They have been able to add genes that give the plant a desirable trait," he said. "The second phase, which is farther down the road, is to alter genes in the plant to improve nutritional quality—such as increasing protein level. Farther out still is multiple-gene engineering, for example, to produce drought resistance."

"There is no magic bullet for drought resistance," Rice said.

Rice said the next step for DeKalb is to evaluate the commercial potential of various genes that then can be field tested in the firm's hybrid seed-corn varieties.

He expects, given the rigor of regular corn-breeding testing, that it will be more than five years before genetically engineered seed corn will be on the market. Necessary government approvals for field testing should come more quickly than in the past because many original fears about genetic engineering have dissipated after a number and variety of experiments, he said.

"For farmers, the promise of biotechnology now has taken one giant step closer to reality," Rice said. "They can look with more confidence at consistent yields and less cost."

The Ticker

DeKalb reports advance in corn

Researchers from DeKalb Genetics Corp. announced Wednesday that the company had produced altered corn plants capable of passing on their new characteristics to the next generation. The technique could allow scientists to develop new corn hybrids that are more resistant to disease and insect resistant, though the DeKalb-based company said it would be years before the corn developed through the process could be marketed commercially. On Monday, a team of scientists from St. Louis-based Monsanto also said they developed a system to genetically alter corn.